

Analyzing the dynamics of groundnut production and marketing in Cross River State, Nigeria

Innocent Asuquo*, Emmanuel Agbachom and Otu Ettah

Department of Agricultural Economics, University of Calabar, Calabar-Nigeria

*Corresponding author's e-mail: innocent_asuquo@yahoo.com; asuquoinnocent8@gmail.com

The production and marketing dynamics of groundnut play a crucial role in shaping the agricultural sector, particularly in Cross River State, Nigeria. This study employs a simultaneous modeling technique to delve into the intricate relationship between production and marketing activities. Primary data, gathered from 1253 farmers and market participants through structured questionnaires, comprehensively covers aspects such as production inputs, output, prices, marketing channels, and market participation. The simultaneous modeling technique provides valuable insights into the interdependencies among production and marketing variables. It unveils the significant influence of variable costs, market prices, and income on groundnut production and marketing strategies. The study not only highlights these interconnections but also identifies critical interventions for enhancing efficiency in both production and marketing processes. Emphasizing the importance of well-targeted policies, the research underscores the need for initiatives focused on quality inputs, effective market information dissemination, and the strengthening of market linkages. These findings contribute to a deeper understanding of the groundnut industry dynamics and offer actionable recommendations for improving overall efficiency and sustainability.

Keywords: Production, marketing, groundnut, dynamics, simultaneous modelling technique.

INTRODUCTION

The economic challenges faced by Nigerians have prompted a reevaluation of government policies, with concerns about issues such as exchange rates, inflation, unemployment, and insecurity. The study reflects on the historical importance of crops like groundnut in Nigeria's economy, emphasizing the decline in production following a shift in focus to crude oil. Despite the crop's South American origin, groundnut became a crucial export commodity, contributing significantly to Nigeria's revenue until the discovery of oil. The paper highlights the need for economic diversification and a return to effective agricultural techniques.

In other words, many Nigerians are of the view that these policies are not well directed and implemented hence, the rise in these social issues occasioned by a drop in general economic activities. These Nigerians are of the opinion that the country was way better in the 50s and 60s when the economy was wholly agriculture dependent. Groundnut, cocoa, oil palm, rubber, et cetera; were very key and were the major export earners for the country to such a great degree that agricultural estates littered the length and breadth of the country. In the southern part of the country where the climate is mostly tropical, crops such as cocoa, oil palm and rubber held sway. Up north, cereals and legumes were in abundance.

So important were some crops like groundnut in the north that 'pyramids' of harvested crops were built by farmers in states like Kano, Kaduna, Bornu, et cetera. Some of these 'groundnut pyramids' were as high as 20ft with a width of about 15m; with an average pyramid having about 15,000 sack bags of 100kg weight and, statistics revealed that 70% of Nigeria's export revenue as at that time, came from groundnut alone (Awoke, 2003). The crop immense contribution to the development of Nigeria climaxed around 1969, when the country was the third largest exporter of groundnut in the world after India and China. It was Nigeria's most important agricultural export commodity as at that time, with the total production rising to 1.95 million metric tonnes in 1972 (Girei, Dauna and Dire, 2013). It was not too long when this production diminished sharply to 0.4 million metric tonnes around 1973-74. This decline according to agricultural experts was as a result of the change in focus and policy arising chiefly to the discovery of crude oil, which was now a key earner for the country, and the neglect of agricultural sector. Though the drought of 1972-73 and the devastating rosette disease of 1975-76 were attributed to this drop by the government, it is pertinent to note that, proper attention accorded the sector before now had waned and incidences affecting same were lightly treated.

Asuquo, I., E. Agbachom and O. Ettah. 2024. Analyzing the dynamics of groundnut production and marketing in Cross River State, Nigeria. *Journal of Global Innovations in Agricultural Sciences* 12:411-416.

[Received 6 Nov 2023; Accepted 13 Dec 2024; Published 30 May 2024]



Attribution 4.0 International (CC BY 4.0)

However, it is noteworthy that, groundnut as a crop had impacted the economic sphere of the country before the advent of crude oil; and with the discovery of oil came the disappearance of the 'pyramids' and a change of focus which obviously affected agricultural sector and continues even till date. Invariably, oil discovery has not really affected the fortunes of many Nigerians as evidenced by infrastructural decay, social upheavals and economic downturn, as most of the accrued revenues are mismanaged, unlike what was obtainable during the agricultural era hence, the clamour by many for a diversification of the economy and a re-engineering of the techniques of years past and particularly agricultural technique that grew the nation's economy.

Nevertheless, it is germane to mention here that groundnut never originated from the country but owe its origin to South America and was only introduced to Africa by the Portuguese in the 16th century (Adinya, Enun and Ijoma, 2010; Bathon and Maurice, 2015; Umaru *et al.*, 2017). The crop is mainly grown for oil and animal feed (Shehu *et al.*, 2010; Taphe, Agbo and Okorji, 2015). It is the world's 13th most important food crop, 4th most important source of edible oil and 3rd most important source of vegetable protein (Tane *et al.*, 2010). Groundnut seeds, also called kernels, contain 40-50% fats 20-55% protein and 10-20% carbohydrates (Ani, Umeh and Weye, 2013). It is a nutritional source of vitamin E and other minerals for human health including niacin, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. It is also useful in the treatment of haemophilia, stomatis and diarrhea and is beneficial for pregnant women, nursing mothers and growing children (Biye, 2016). The kernel can be eaten raw, roasted or boiled and the groundnut vines are used as cattle fodder; other extracts can also be used as animal feeds (Taru *et al.*, 2007). In other words, almost every part of the crop is used in some way. The multiple uses of the groundnut plant makes it an important food and cash crop for domestic consumption and export in many countries of the world where the crop thrives. In most of these countries, about 50% of total groundnut production is used for oil extraction, 38% for confectionary and 12% for seed (Taru *et al.*, 2008). The crop's average yield is 1.8 tonnes per hectare (Food and Agriculture Organization Corporate Statistical Database (FAOSTAT, 2011). China, India, Indonesia, Nigeria, Senegal, Sudan, United States of America, and Myanmar are the major groundnut growing countries (FAOSTAT, 2011), with over 95% of total production coming from developing countries of Asia, Africa, and South America. Africa accounts for 46% of global cultivation, with West Africa producing the major share, and Nigeria contributing 51% of the region's total production.

In the South-South region of Nigeria, Cross River State produces the most, contributing 64% of the region's total production, with Bekwarra Local Government as the epicenter (Adinya *et al.*, 2010). Like most parts of Africa, the production system in Bekwarra is characterized by small holders, who cultivate small land holdings using labour - intensive cultivation procedure. Characteristically, these group of farmers have low commercialization level (Harun

and Legesse, 2023). The production system of groundnut like many small holding in Nigeria, limits the production capacity of groundnut farmers. However, the many benefits derived ensures the maximum cultivation of the crop year after year. Nevertheless, even with this avowed benefits, production of the crop has declined in recent times, hence the need for this study.

Overtime, some factors were adduced for this trend in production (Adinya *et al.*, 2010; Edet, Udoh and Ifang, 2018), however; these studies focused on factors that did not directly impinge the production trend – exogenous factors. In other words, the key factors were neglected and the marketing function, which is an intimate part of the production process performed by the farmers was also not captured. In addition, constraints militating against production and marketing of the crop were sparingly mentioned. This is where this study departs from the previous studies and why it is relevant. Key factors that affect production and marketing of the crop and particularly the endogenous factors such as the previous and current market prices, the income earned and the average costs of production were simultaneously considered.

The production of groundnut in Bekwarra is hampered by a variety of factors among which are; crop variety planted, pests and diseases, low yield and poor cultural practices, et cetera. Marketing is also affected by transportation cost, information asymmetry, and bad road network among others. These problems, together, negatively affect efficient production and marketing of the crop. It follows, therefore, that on the production side, though small and fragmented land holdings remain a key factor in expanding production, the aforementioned factors are mostly contributory. On the marketing side, standardization and information asymmetry affect substantially the efficiency.

The literature review provides an overview of groundnut as a crop, its nutritional value, and historical significance in Nigeria's economy. The decline in groundnut production is attributed to factors such as drought, rosette disease, and neglect of the agricultural sector due to the discovery of crude oil. The study distinguishes itself by focusing on both endogenous and exogenous factors affecting groundnut production and marketing. The discussion emphasizes the importance of considering market prices, income, and production costs in understanding the dynamics of groundnut production.

MATERIALS AND METHODS

This section describes the study area (Cross River State), the population of groundnut farmers, and the sampling technique used to select respondents. The research utilized a simultaneous equation model to estimate the production and marketing functions of groundnut. The Gini coefficient was employed to analyze the market structure, and a Likert scale was used to assess constraints against effective production and marketing.

Description of the study area: Cross River State is a coastal state located in the south-south region of Nigeria, and lies



between latitude 4°28'N and 6°55'N and longitude 7°50'E and 9°28'E of the Greenwich Meridian. It is located within the tropical rainforest belt of Nigeria and shares boundaries with the Republic of Cameroon in the east, Benue State in the North, Ebonyi and Abia States in the West, Akwa Ibom State in the South West and the Atlantic Ocean in the south. It has a total land area of 22,342.176 square kilometers and an annual rainfall of 2942mm to 3424mm. It has five distinct ecological zones; mangrove and swamp forest towards the coast, tropical rainforest in some parts of the south and north, montane vegetation in the highlands of Obudu, and savannah woodland covering most northern part of the state. Apart from groundnut which is grown extensively in the northern part of the state and mostly in Bekwarra, other crops cultivated are, rubber, cocoa, oil palm, cassava, plantain, banana, yam, maize, melon and assorted vegetables. With a population of 4,406,200 persons, ¾ of which are farmers and are small-scale (National Population Commission, NPC, 2022), the state is divided into 18 local government areas and 3 agricultural zones of Calabar, Ikom and Ogoja.

Bekwarra is the commercial hub of groundnut production and marketing in Cross River State, and it's located between latitude 6°41'34"N and longitude 8°58'03"E with a population of 211,644 inhabitants, 90% of which are farmers.

Sampling size and sampling technique: The population of study consists of all groundnut farmers, who produce and market the crop as well. According to Cross River Agricultural Development Project (CRADP, 2021) the number of registered groundnut farmers in the study area as at 2022 was 15,745. Multi-stage sampling technique was adopted in selecting the respondents. First, ten farming communities actively involved in the production and marketing of the crop were purposively selected and they were: A) Abuochiche (2120), B) Afrike ochabge (1843), C) Afrike okpeche (1360), D) Benten (2310), E) Ebewo (981), F) Gakem (2111), G) Ooukpuru (967), H) Ugboro (1467), I) Nyanya (2006), and J) Ukpah (580).

The required sample size was then calculated from the population of farmers from the different farming communities using the formula given by Kothari and Garg (2014):

$$n = \frac{\frac{Z^2 \alpha}{2N\sigma^2}}{(N-1)e^2 + \frac{Z^2 \alpha}{\sigma^2}}$$

Where, n= Sample size. N = Size of the population, e = Estimation error – 0.5. σ = Standard deviation of the population – 5%. $Z\alpha/2$ = The value of the standard variate at given confidence level (1.96 for 95% C.L)

Random numbers table was then used in selecting the respondents for the interview and administration of data collection instrument. Agricultural extension officers were used in administering the questionnaires.

Data analysis and estimation technique: This study is guided

by three objectives. Objective one is to estimate the production and marketing functions of groundnut in the study area. A simultaneous equation model was used in estimating the functions and it's expressed as:

$$Y_p = \alpha_0 + \alpha_1 P_t + \alpha_2 C + \alpha_3 P_{t-1} + \mu_1 \quad (1)$$

$$M = b_0 + b_1 Y + b_2 P_t + \mu_2 \quad (2)$$

Where, Y_p = Quantity of groundnut produced/ha (kilogram), M = Quantity of Groundnut Marketed (Quantity sold in kilogram), P_t = Current market price (Naira (₦)), C = Average cost of production (₦/ha), P_{t-1} = Previous market price (₦), Y = Average income (₦), μ_1 x μ_2 = Error terms.

By the Order conditions for Identifiability, equation (2) is over identified and equation (1) is exactly identified. Therefore, the two-stage least squares (2SLS) was applied in estimating the simultaneous model. Consequently, the reduced form equations for the model is given as;

$$P_t = \delta_0 + \delta_1 c + \delta_2 P_{t-1} + \delta_3 y + \lambda_t \quad (3)$$

$$Y_p = \delta_4 + \delta_5 c + \delta_6 P_{t-1} + \delta_7 y + W_t \quad (4)$$

Where P_t and Y_p are the current price and quantity and are the endogenous variables, and the rest are exogenous variables and are as previously defined.

In objective two, the distribution channel and structure of the market are analyzed and, the Gini- coefficient was deployed in analyzing the market structure. While in objective three, a five point Likert scale was used in examining the constraints against effective production and marketing. A questionnaire containing fourteen variable items/ constraints was presented to the respondents arising from a pilot survey, and the items were graded based on farmers' perception on how each affected them. '5 = Strongly Agree', '4 = Agree', '3 = Undecided', '2 = Disagree', '1 = Strongly Disagree'. A weighted mean score was calculated after the mean score for each variable was arrived at. Any mean score above the weighted mean score was term 'serious' in its impact on production and marketing otherwise, 'not serious'.

RESULTS AND DISCUSSION

Production and Marketing Functions of Groundnut: The results present Ordinary Least Squares (OLS) and Two-Stage Least Squares (2SLS) estimates of production and marketing functions. The study finds that variable costs, market prices, and income significantly impact groundnut production and marketing. The market structure analysis reveals a high level of inequality and concentration in sales revenue, indicating inefficiency. Constraints against production and marketing, such as poor road networks, transportation costs, and inadequate storage facilities, are identified, with 50% considered serious issues.

Table 2b presents the Ordinary Least Squares- OLS and the 2SLS estimates of production and marketing functions in the study area and shows that the two regressions are virtually the

Table 1. Selection of sample size.

Farming communities	A	B	C	D	E	F	G	H	I	J	Total
Population	2120	1843	1360	2310	981	2111	967	1467	2006	580	15745
Sample farmers	130	128	126	130	121	130	121	126	129	112	1253



same. Does that invalidate the 2SLS? Not at all. Rather, in the present situation, the R^2 value in the first stage is very high, thus making the estimated \hat{Y}_p and P_t virtually identical with the actual Y_p and P_t . Therefore, in this case the OLS and the second-stage will be more or less similar. The idea behind the 2SLS is to purify the stochastic explanatory variable of the influence of the stochastic disturbance term. As shown in the 2SLS table, the diagnostics such as Durbin Watson-DW, Wu-Hausman, which test the endogeneity are all plausible. The R^2 , which measures how well the entire regression model explains the changes in the value of the dependent variable is 0.32 for quantity produced and 0.99 for quantity marketed. However, as previously explained above, simultaneous equation models must be “reduced” into a form that is estimable; which measures the “immediate impact or short-run multipliers” (Gujarati and Porter, 2009). Accordingly, the 2SLS table shows that the Average Costs of Production (LnTVC) is significant at 1% in Quantity Produced and, Current Market Price and Average Income are also significant at 1% in Quantity Marketed. This implies that, the three variables determine extensively the production and marketing trend of the crop year after year. Consequently, for every 1kg of groundnut produced, an average cost of ₦1.1162 (\$ 0.00159) is incurred in the current period. And should this keep rising, the production will definitely drop. Invariably, the wiggly nature of the production trend may be attributed to the cost implication of producing the crop. The table also reveals that, for every 1kg marketed, the Current Market Price drops by ₦1.25. This further explains the decline in production overtime as a rise in production cost with a concomitant drop in current market price will discourage many farmers from producing in the next production year. And for the few who may be willing to still produce, they may be expected to make ₦0.98 as income per kg.

The Marketing Channel and Structure in the Distribution of Groundnut

Marketing Channel: Marketing channel is the path through which a commodity moves from the producer to the final consumer. The marketing channel of groundnut in the study area shows that farmers usually sell their products directly to either rural assemblers or commissioned agents, depending on the pre-arrangements between these two. The product is then sold to wholesalers who either sell to processors or to retailers

that eventually sell to final consumers. Processors convert the crop into forms that can be used in animal feed or other uses. The marketing channel is as represented diagrammatically in Fig. 1.

Market Structure: Market structure refers to the degree of competition in the market system. It is the concentration of buyers and sellers in the market. Table 2a presents the market structure of groundnut in the study area. According to the Table, the estimated Gini- coefficient for groundnut marketing in the study area is 0.54706, indicating a high level of inequality and concentration in the sales revenue of the farmers thus, a high inefficiency in the market structure. According to Dillion and Hardaker (1993), a Gini-coefficient value of more than 0.35 is high and indicates inequitable distribution of sales or sales income. Figure 2 further expatiates Table 2 and shows clearly the inequality as exemplified by the Lorenz curve.

Constraints against production and marketing of groundnut: Increasing production level has bearing consequences on farmers’ income and the general economy. Table 3 revealed that a drop in the market price with an increase in the variable costs are very key in determining farmers’ income. A breakdown of the constraints in Table 4 shows that the weighted mean score which measures the overall impact of these variables was 4.55. Accordingly, seven out of the fourteen constraints, representing 50% of the constraints, had serious impact on production and marketing efficiencies.

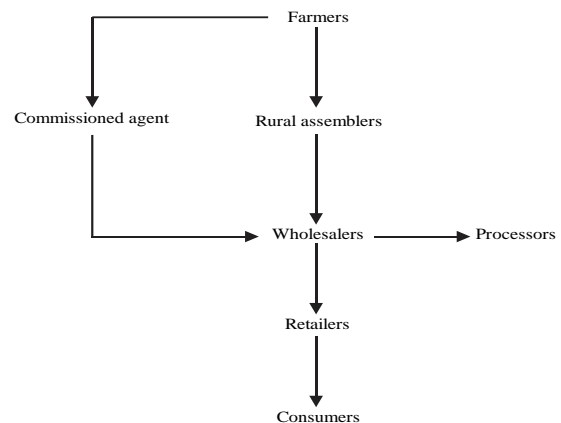


Figure 1. Marketing channel of groundnut

Table 2a. Computation of Gini coefficient for groundnut marketing in the study area.

Class of income	Number of farmers	Proportion of farmers (X_i)	Cumulative proportion of farmers	Income of farmers	Proportion of farmers	Cumulative proportion of farmer (Y_i)	$X_i Y_i$
<300,000	348	0.277733	0.27778	6640600	0.139049	0.13905	0.03862
300,001-400,000	181	0.144453	0.42220	4459450	0.093378	0.23240	0.33569
400,001-500,000	111	0.088587	0.51100	3490100	0.073080	0.30550	0.02716
500,001-600,000	111	0.088587	0.59989	4464200	0.093477	0.39890	0.03546
600,001-700,000	167	0.133280	0.73330	7693900	0.161105	0.56000	0.07467
700,001-800,000	84	0.067039	0.79999	4390050	0.919240	0.65200	0.04347
>800,000	251	0.200329	1.00000	16618850	0.347987	1.00000	0.20000
Total	1253	1.000000		47757150	1.000000		0.45294
Gini = $1 - \sum X_i Y_i$							0.54706



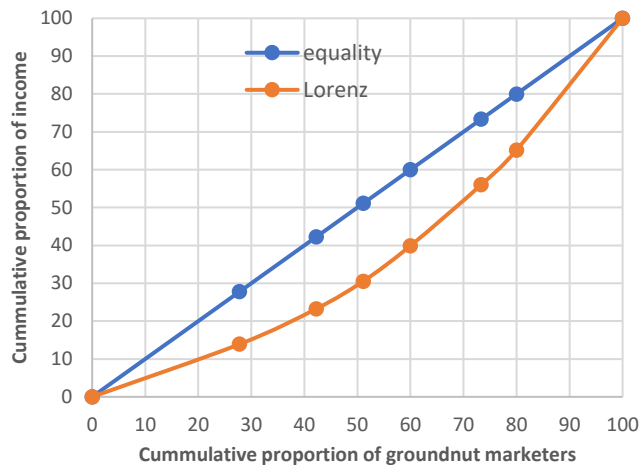


Figure 2. Cumulative proportion of groundnut marketers

It is important to point out that, of these constraints, inadequate financial resources and the problem of pests and diseases can seriously reduce production and affect farmers' income. Financial resource plays a key role in managing variable and other cost items. The variable costs items in the constraints variables that impacted more were cost of transportation, inadequate storage facilities and high cost of seeds/planting materials. A further analysis also shows that constraints such as, land tenure problem, the crop variety cultivated, market taxes, flooding of farmlands, activities of middlemen, costs of other inputs, though serious, could still be managed.

Conclusion: Groundnut is a key crop in economic dynamics of Nigeria but production in recent times has plummeted with many reasons advanced for this. Some of these reasons as stated earlier may be cogent but were not comprehensive enough to conclude on the production trend as they were basically exogenous. Many production activities according to

Table 2b. OLS and 2SLS estimate of production and marketing functions

Dependent variable			
OLS estimates of quantity produced and marketed (t-ratios in Parentheses)	In previous price	LnQp	LnQm
	Ln previous price	-.1784128 (-1.48)	.0100243 (0.80)
	Ln current price	1.057726 (0.75)	-1.035636 (-7.17)
	Ln TVC	.3875807 (5.87)	-
	Ln income	-	.9683954 (108.09)
	Constant	-9.835276 (-0.72)	.8373126 (0.60)
	R2	0.32	0.9932
F-ratio (3,86)			
		13.81	4195.63
Dependent variable			
2-SLS Least-squares Estimates of Quantity produced and marketed (Z-ratios in parentheses)	In previous price	LnQp	LnQm
	Ln previous price	-.9028914 (-1.06)	.0437183 (0.72)
	Ln current price	-.5769662 (-0.18)	-1.251256 (-6.37)*
	Ln TVC	1.116285 (4.37)*	-
	Ln income	-	.9816142 (74.03)*
	Constant	5.226427 (0.20)	2.477414 (1.56)
	R2	0.3251	0.9925
	DW		89.1149
	Wu-Hausman		2785.71

* - significant @ 1%

Table 3. Constraints against effective production and marketing of groundnut.

Sr.	Problems	SA(5)	A(4)	UD(3)	D(2)	SD(1)	Cum	Mean
1	Poor road network	1030(82)	223(18)	-	-	-	6042	4.82
2	Transportation cost	919(73.3)	334(26.7)	-	-	-	5931	4.73
3	Storage cost	529(42.2)	724(57.8)	1(0.08)	-	-	5544	4.42
4	Inadequate storage facilities	752(60)	501(40)	-	-	-	5764	4.60
5	Cost of seed	794(63.3)	459(36.7)	-	-	-	5806	4.63
6	Cost of other inputs	473(37.7)	780(62.3)	-	-	-	5485	4.38
7	Inadequate production capital	710(56.6)	543(43.4)	-	-	-	5722	4.57
8	Activities of middlemen	446(35.6)	807(64.4)	-	-	-	5458	4.41
9	High market taxes	627(50)	626(50)	-	-	-	5639	4.50
10	Flooding of farmlands	682(54.4)	543(43.3)	-	-	28(2.2)	5610	4.47
11	Information asymmetry	529(42.2)	724(57.8)	-	-	-	5541	4.42
12	Pests and diseases	877(70)	376(30)	-	-	-	5889	4.70
13	Problem of land tenure	766(61.1)	487(38.9)	-	-	-	5778	4.61
14	Poor crop variety	529(42.2)	724(57.8)	-	-	-	5541	4.42

n = 1253, constraint variables = 14, weighted mean score = 63.68/14 = 4.55, $X \geq 4.55$ = serious problems, $X \leq 4.55$ = not a serious problem, SA = strongly agree, A = agree, UN = undecided, D = disagree, SD = strongly disagree, CUM = cumulative frequency response.



many researches are rather endogenous, hence, this study focused on providing an in-depth analysis and a direction on the possible endogenous causes and ways of invigorating and building back production. Consequently, the paper emphasizes the importance of addressing endogenous factors in understanding groundnut production dynamics. The study recommends interventions to enhance production efficiency, considering factors such as variable costs, market prices, and income. The inefficient market structure highlights the need for reforms to ensure equitable distribution of sales income. Overall, the paper calls for comprehensive measures to rejuvenate groundnut production in Cross River State and Nigeria as a whole.

Author's contributions: IA conceived and wrote the original manuscript. EA reviewed the manuscript and did the literature search, while OE managed the data collection and analyses.

Conflict of interest: There was no conflict of interest amongst the authors or with anyone else.

Acknowledgements: The authors acknowledge all the extension officers in Cross River State who assisted with administration of the questionnaire and the collection of data.

Funding: Funding for this study was provided by the authors, no external funds were involved.

Data availability: Data used for this study is original and has not been used or published anywhere else. It can be made available on request.

Publication consent: The authors give their consent for the manuscript to be published in JGIAS.

REFERENCES

- Adinya, I. B., E. E. Enun and J. U. Ijoma. 2010. Exploring Profitability Potentials in Groundnut (*Arachis hypogaea*) Production through Agroforestry Practices, Nigeria. The Journal of Animal & Plant Sciences 20:123-131.
- Ani, D. P., J.C. Umeh and E.A.Weye. 2010. Profitability and Economic Efficiency of Groundnut Production in Benue State, Nigeria. African Journal of Food, Agricultural, Nutrition and Development 13:8092-8105.
- Awoke, M. U. 2003. Production Analysis of Groundnut (*Arachis hypogaea*) in Ezeagu Local Government Area of Enugu State, Nigeria. Global J. Agr. Sci. 2:40.
- Bathon, A.H and D.C. Maurice. 2015. Analysis of Technical Efficiency of Groundnut-Based Cropping Systems among Farmers in Hong Local Government Area of Adamawa State, Nigeria. Journal of Agricultural Economics, Environment and Social Sciences 1:61-69.
- Biye, S.U. 2016. Analysis of Production Efficiency and Profitability among Groundnut (*Arachis hypogaea*) Farmers in Bauchi state, Nigeria. Unpublished PhD Thesis, Department of Agricultural Economics & Extension, School of Agriculture and Agricultural Technology, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria.
- Cross River Agricultural Development. CRADP. 2021. Cross River State Ministry of Agriculture, State Secretariat Complex, Calabar-Nigeria.
- Dillion, J.L. and J.B. Hardaker. 1993. Farm Management Research for Small Farmer Development. Food and Agriculture Organization of the United Nations, Rome.
- Edet, E.O., P.O. Udoh and E.D. Ifang. 2018. Resource Use Efficiency of Groundnut Farmers in Bekwarra Local Government, Cross River State, Nigeria. Global Journal of Agricultural Sciences 17:75-84.
- Girei, A. A., Y. Dauna and B. Dire. 2013. An economic analysis of groundnut (*Arachis hypogaea*) production in Hong Local Government Area of Adamawa State, Nigeria. Journal of Agricultural and Crop Res. 1:84-89.
- Gujarati, D.N. and D.C. Porter. 2009. Basic Econometrics, 5th edition. New York: McGraw-Hill.
- Harun, M. E and Legesse, B. 2023. Farmer's Risk Rating and Crop portfolio choice in kewot woreda, north Ethiopia. Journal of Global Innovations in Agricultural Sciences 11:49-54.
- Kothari, C.R. and G. Garg. 2014. Research Methodology: Methods and Techniques, 3rd edition. New Delhi: New Age International Publishers.
- National Bureau of Statistics. NBS Annual Abstract of Statistics. 2022. Retrieved from <https://nigeriastat.gov.ng/elibrary/>.
- National Population Commission. NPC. 2022. Retrieved from <https://nationalpopulation.gov.ng/>.
- Ogunniyi, L.T., A.O. Ajao and A.A. Adepoju. 2012. Technical Efficiency in Groundnut Production in Saki Agricultural Zone of Oyo State, Nigeria. International Journal of Applied Agricultural Research 7:111-118.
- Shamsudeen, A., S.A. Donkoh and G. Sienso . 2011. Technical Efficiency of Groundnut Production in West Mamprusi District of Northern Ghana. Journal of Agriculture & Biological Science 2:071- 077.
- Shehu, J.F., J.T. Iyortyer, S.I. Mshelia and A.A. Jongur. 2010. Determinants of Yam Productivity and Technical Efficiency among Yam Farmers in Benue State, Nigeria. Journal of Social Sciences 2:24-35.
- Taphe, B.G., F.U. Agbo and E.C. Okorji. 2015. Resource Productivity and Technical Efficiency of Small Scale Groundnut Farmers in Taraba State, Nigeria. Journal of Biology, Agriculture and Healthcare 5:25-34.
- Taru, V.B., I.Z. Kyagya, S.I. Mshelia and E.F. Adebayo. 2008. Economic Efficiency of Resource Use in Groundnut Production in Adamawa State of Nigeria. World Journal of Agricultural Sciences 4:896-900.
- Umaru, B., A. Jongur, L. Haruna and Y. Ya'u Adamu. 2017. Determinant of technical efficiency of groundnut production in Bauchi State, Nigeria. FUW Trends in Science & Technology Journal 2:492-495.

